Roland
MDX-40A

MDX-40A
Step-by-step guide
Vol.1

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Introduction

・This guide is designed to demonstrate and help you understand the workflow of one side cutting with MDX-40A. If you read through these notes with your own model, you will understand the principles of operation.

・The SRP Player supplied with your machine, used with this guide is ver. 1.17. If your SRP Player is a different version, the specification and functions described may not appear the same.

You can download the latest software updaters and Windows drivers from our corporate website www.rolanddg.com.

Please note, you need to have the SRP Player installed from the CD, before using an updater.

Contents

Think how best to cut the object 4
Making a prototype with single side cutting only.
The method for two sided cutting a solid object using supports and frame.
The method for two sided cutting a solid object without supports and frame.
The method using rotary axis (4 axes).
Combined cutting

One side cutting

1 : Before you start 6
Think about material and tools 7
The workflow of this guide 9

2 : Before you start cutting 10
2-1 What you will need 11
2-2 Equipment Configuration（Machine, Software, Driver） 12
MDX-40A transportation clamps 12
Preparation of PC and software 13
SRP Player settings 15
2-3 Starting the MDX-40A and VPanel 16

3 : Setup Tasks. Cutting the Base and workpiece 17
3-1 Preparation of the surface - levelling the base 19
Preparation of the base 19
Installing the surface levelling tool 20
3-2 Setting the origin point of MDX-40A 21
Setting the X- and Y- axis Origin Point 23
Setting the Z-axis Origin Point 24
Surface levelling the base 29
Preparation of the workpiece for model and surface levelling .....

4 : Creating the cutting tool path .....
Setting of the each process .....

5 : Cutting the model .....
Start cutting .....

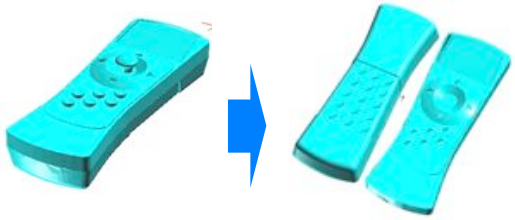
Think how to cut the object

Think of the most appropriate method of cutting, taking into account model shape, material characteristics, machine cutting dimensions and capability of the software.

Making a prototype using one side cutting only

One side cutting, which creates a solid model by cutting two separate components is the simplest method for creating a model.

MDX-40A Step-by-step guide
Step1 One side cutting

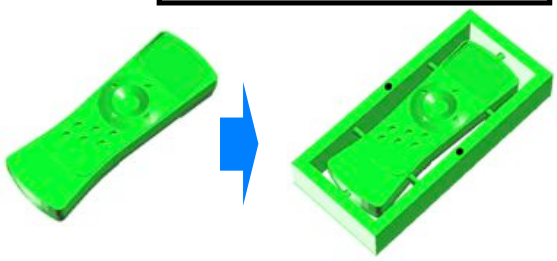


- Single side cutting can make full use of the cutting machine's table to create larger models and eliminates the need to remove support material.
- Gluing the two components is necessary after cutting. Accurate alignment of the two components is critical.

The method for two sided cutting a solid object using supports and frame.

This method adds supports and a surrounding frame to the 3D data and manually flips the frame to cut both sides.

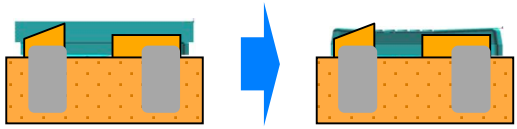
MDX-40A Step-by-step guide
Step2 Two sided cutting



- No need to split the original design, no alignment issues and no gluing required.
- Careful removal of the model from the supports and hand finishing required.

The method for two sided cutting a solid object without supports and frame.

This method requires you to create a support base for the pre-cut side of the model to allow you to cut the second side.



- Finished models will be smooth and without the need to remove any supports. Alignment should be accurate.
- Preparing an accurate and stable support base for the pre-cut side may be time-consuming. Additional fixing such as glue or putty may be required.

The method using rotary axis (4 axis).

This method uses the ZCL-40A rotary axis to automatically rotate the model in order for you to cut from multiple angles.

ZCL-40A Step-by-step guide
Step1 Basics

ZCL-40A Step-by-step guide
Step2 Cutting utilizing the area

- A simple method for cutting multiple sides. This makes it easier to create accurate complex models.
- Cutting area is limited to the rotary axis' acceptable material size.

Combined cutting

Some objects may require you to create separate components using a combination of the above cutting methods.

One side cutting
With MDX-40A
and
SRP Player

Step 1.

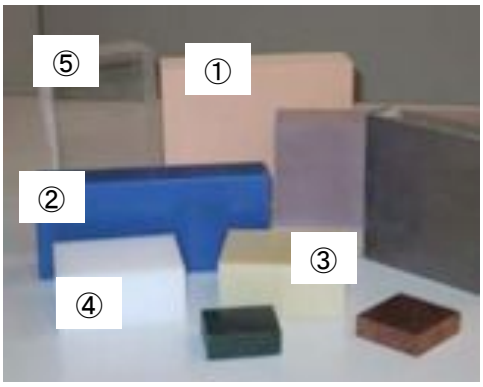
Before you start

Choose your material and tools and think about the process required to complete the model.

Think about the material and tools

In this guide, a 6mm diameter ball endmill is used for roughing and finishing cutting and Sanmodur 7K has been chosen as the material. However, cutter sizes will be influenced by your part.

1 Choose the material



Consider the following when choosing your material:
- How strong does it need to be?
- How durable does it need to be to withstand operation testing?
- Once cut, will it need painting or coating?
- Does your design require a particular material finish such as wood grain or high gloss?
- Is the material readily available?
- Is the material cost appropriate to the project?

※If there is no specific requirement, or you have less experience in cutting, you may wish to use a modelling board such as Sanmodur. Sanmodur 7K is what is typically used in Roland DG Japan (local alternative modelling boards are also available).

The MDX-40A was specifically developed to work with a wide range of synthetic and natural materials

The following list describes the key characteristics of the most popular synthetic resin materials:

① Sanmodur

Also known as chemical wood or modelling board. There are many variations in density, colour and surface finish. All are lightweight and easy to cut. The cutting waste is a powdery dust. It is often used for initial concept prototypes in order to check shape, size, etc.

② Modelling Wax

This hard form of wax is supplied in varying blocks, tubes, sheets and cylinders for modelling. It is easy to cut but can also melt with the heat generated by the cutting tool. Modelling wax is particularly popular for investment casting products such as jewellery and dental applications.

③ ABS

ABS is a high-impact resistant plastic which is light and rigid, making it suitable for many moulding and machining applications. It offers good electrical insulation, but has low resistance to certain chemicals. It is widely used for the automotive parts, helmets and tubing applications.

④ Polyacetal resin

Also known as POM (polyoxymethylene), Jura Kon, and acetal resin. Used heavily in thermalplastic applications for precision mechanical parts. It is durable, dimensionally stable and resists oil and solvents. Commonly used to make small mechanical components such as gears in CD players, etc.

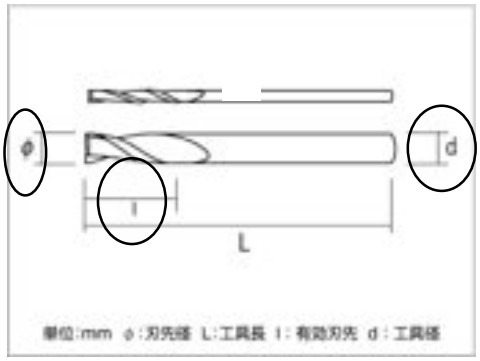
⑤ Acrylic

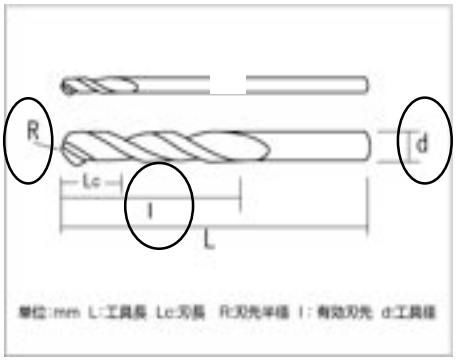
Acrylic is a hard weather resistant, transparent thermoplastic which can be cut, engraved, glued and thermo-formed. It is widely used for signage, display cases, aquariums, screen protectors and light clusters – basically where a UV stable transparent material is required. The material is prone to scratching and can melt when machined.

Think about the material and tools

2 Choose the tool

The main characteristics when choosing a tool is the tip shape, blade diameter, flute length and shaft diameter.





For Rough cutting

For fast and efficient rough cutting, you should use the widest tool which will take away the majority of the unwanted material as quickly as possible. The largest diameter tool you can use with the MDX-40A is 6mm. However, this may be too wide for the geometry of smaller models and could leave too much material behind for a fine finishing tool to remove in holes, cavities, etc. Using a wider tool for roughing also means a finer finishing tool will be required during the cutting process and will have to be changed manually. Alternatively, the whole model can be cut using a smaller tool which can both rough and finish cut, but this may take considerably longer to finish. So you must decide whether production time is more important than unattended operation.

For finishing

Use the tool with the diameter that can fit into the smallest space of the model.

Select the square or ball end tool depending on whether the majority of the model has flat or curved surfaces.

Shape of the tool tip

Square (Straight)

Square end mills have cutting blades on the bottom and sides. Although flat, the tips have a gap in the blades in the centre, which makes them suitable for profiling, surfacing and roughing, but not drilling. Slot drills have continuous blades at the tip which makes them better suited for drilling.

Ball

This tip has a rounded tip like a ‘ball.’
It has cutting blades on the tip and the sides.
It is very effective as a finishing tool for curved surfaces, giving a very smooth finish.

Radius

Also known as ‘bull nose’, the tool has a flat tip and rounded corners, combining the elements of square and ball tools. There are cutting blades on the tip and the sides. These tools tend to cut faster than the ball equivalent because less toolpaths are required. It is commonly used for roughing.

Conical

This V-shaped tool has a flattish tip and is used extensively for engraving and also for fine detail work such as in jewellery wax modelling. The tip sizes vary according to the width of cut required.

The workflow of this guide

Surface levelling the base

Use a 6 mm diameter straight endmill.
This will give a level base for the material, ensuring cutting depths across the model are even.

Surface level the modelling material

Like the process of surface levelling the base, this cuts the model surface so that the thickness of the workpiece is even and appropriate for the size of model.

Rough cutting and Finishing

This tutorial uses the same 6mm straight end mill to complete the surfacing, roughing and finishing.

Completion

Remove the completed model from the base.

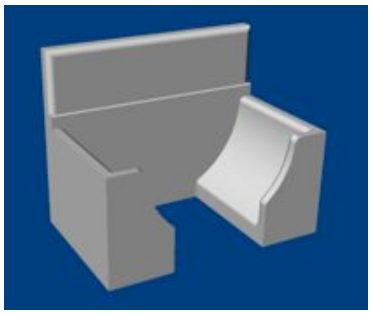
Step 2.

Before you start cutting

This step highlights preparation required, materials needed and the necessary equipment configuration required to commence the tutorial.

2-1 What to have ready

Model data file
Z0SENSOR_HOLDER.igs
（IGS format）



This guide
MDX-40A
Step up guide Step1
One side cutting version

Double sided tape
Scraper *(Long stainless steel kitchen spatulas are particularly good for this)*

Optional

MDX-40A Starter kit
※all the necessary equipment is included in the starter kit, comprising of modelling material, tool, parallel pins, guide and cutting data.

Material size

Workpiece for modelling (Sanmodur) 1 piece
120 x 100 x 30mm

Workpiece for base 1 piece
(wider than the workpiece for modelling)
248 x 248 x 30mm

Tool

Φ6mm Straight endmill
（For surface levelling/Roughing/Finishing)

MDX-40A Accessories

Spanner - 2 sizes
Hexagonal Wrench – 2 sizes
Roland Software Package（CD-ROM)
SRP Player（CD-ROM)
Collet（φ6）
USB Cable

MDX-40A retaining clamps for transportation

1 Ensure the retaining clamps for shipment are removed from the MDX-40A

See User's manual
Chapter 2 Installation
2－2 Removing and Storing the Retainers

Preparation of PC and software

1 Prepare the PC which is installed Windows XP/Vista (32bit)

2 Install Windows driver and software

See User's manual
Chapter 2, Installation and Set up
Refer to 2－4 Installing and Setting up the Software
Installing the Windows-based Driver
Installing the V-Panel and Other Software

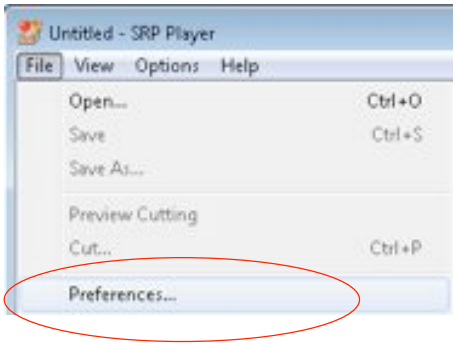
3 Install SRP Player

Refer [SRP Player install guide]

Setting up SRP Player

1 Start SRP Player

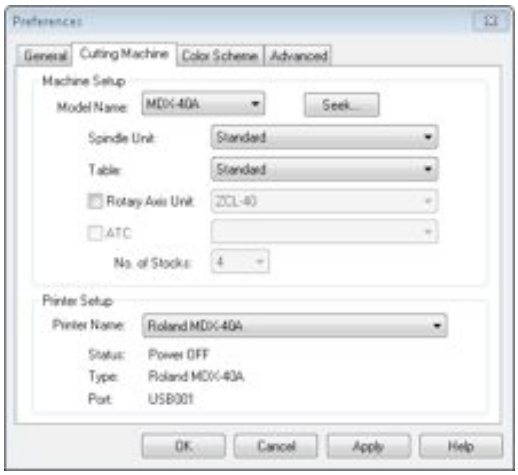
2 From menu, select [File][Preferences], followed by [Modeling Machine] tab to display the choice of machines.



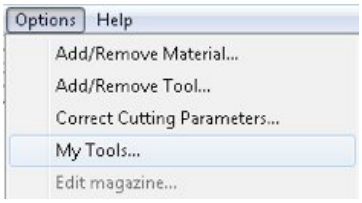
3 ①Select MDX-40A

②Remove the check next to Rotary axis unit。

③Choose [Roland MDX-40A〕for printer

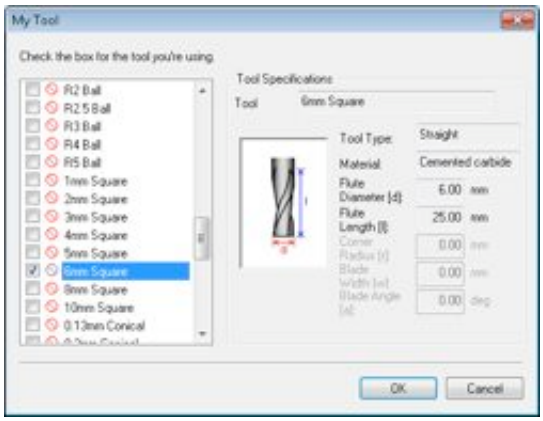


4 From the menu, select [Option], [My Tools] to display the My Tool selection window



5 Select the following tool

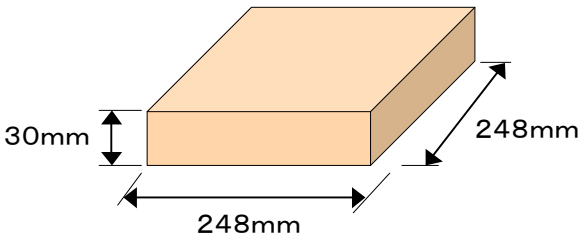
6mm Square

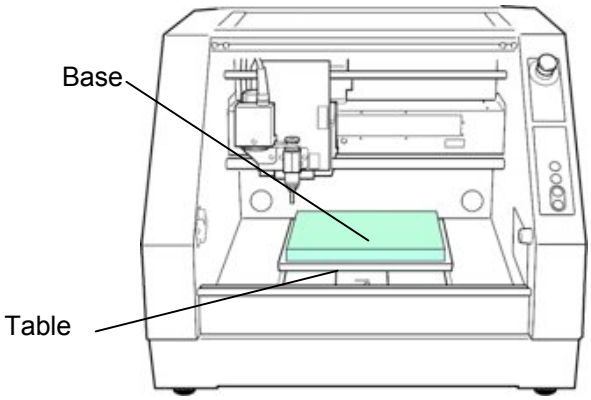


Preparation of the base

1 Prepare the base workpiece to attach to the table. This is a sacrificial base.

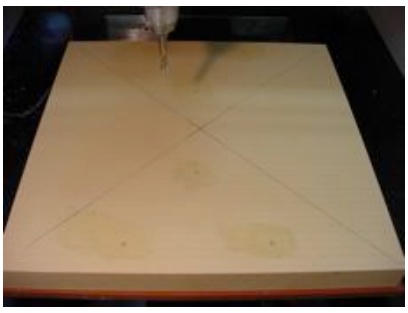
Ensure the base workpiece is bigger than the model workpiece. Clean the MDX40A table to remove any dust or swarf.





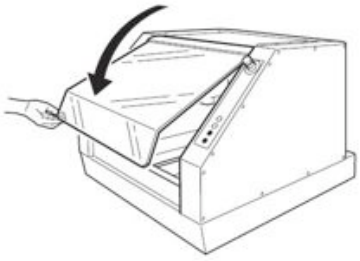
2 Apply just enough double sided tape to the base Too much and you wont get it off. Ensure the tape is flat, free of swarf and does not wrinkle or overlap other pieces.

3 Fix the base material to the table. Ensure it is stuck firmly.

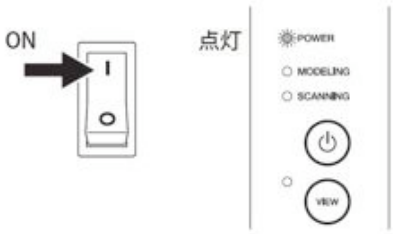


2-3 Start the MDX-40A and VPanel

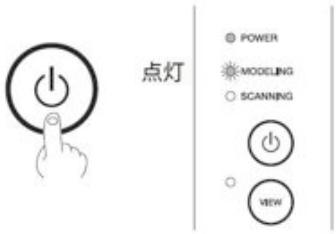
1 Close the front cover



2 Turn on the main power switch on the MDX-40A



3 Turn on the sub power on the operation panel



4 If you use Windows XP
Select [Start] menu → [All program] → 「Roland VPanel for MDX-40A」
→ 「VPanel」

Step 3.
Setup Tasks. Cutting the Base and workpiece

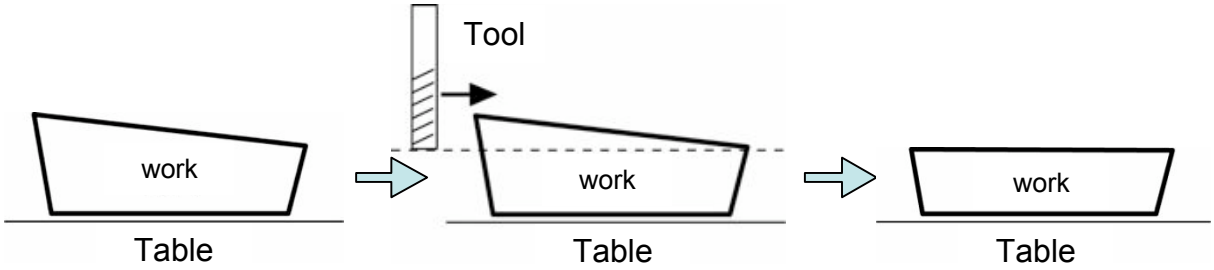
Levelling the the base on the table, and preparing the model workpiece on the base.

What is the base?

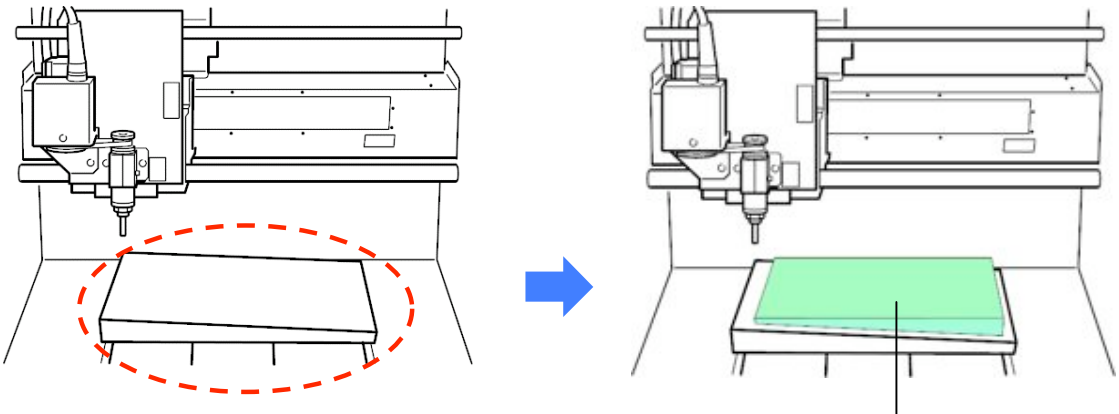
If the model workpiece is fixed directly to the table, the tool may damage the table when it makes the deepest cuts. Applying a base to the table avoids cutting the table and also enables you to create positioning frames or holes. It also means stronger adhesives such as glue can be used without damaging the table.

What is surface levelling?

Material thickness can vary throughout a sheet. Surface levelling creates a flat surface relative to the MDX-40A.



The MDX-40A machine table may not be completely level in relation to the spindle travel. Surface levelling the base material will resolve any variation.

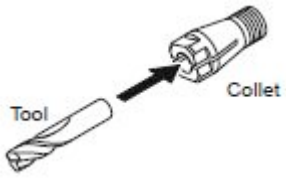


Exaggerated illustration

The surface levelled based

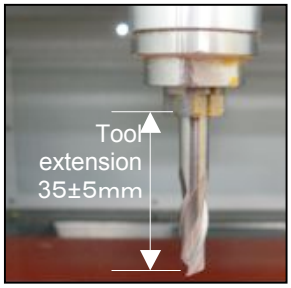
Installing the surface levelling tool

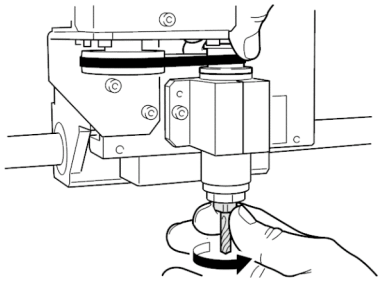
1 Install the collet and tool appropriate for cutting.
This tutorial requires the 6mm collet and 6mm straight end mill.



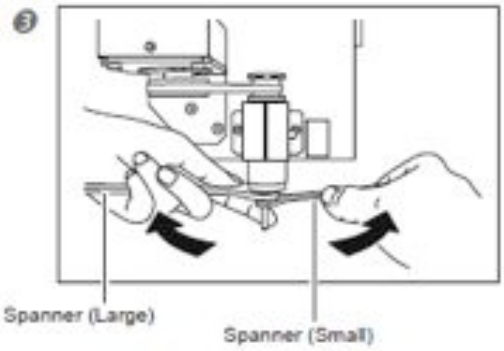
2 Insert the tool from below. The tool extension length needs to exceed the cutting depth of the workpiece. In this tutorial, the cutting depth of the model is 28mm, so set the tool extension from the collet to roughly 35mm (±5mm).

※After surface-levelling the base, continue on to surface-levelling the model workpiece and making the model.



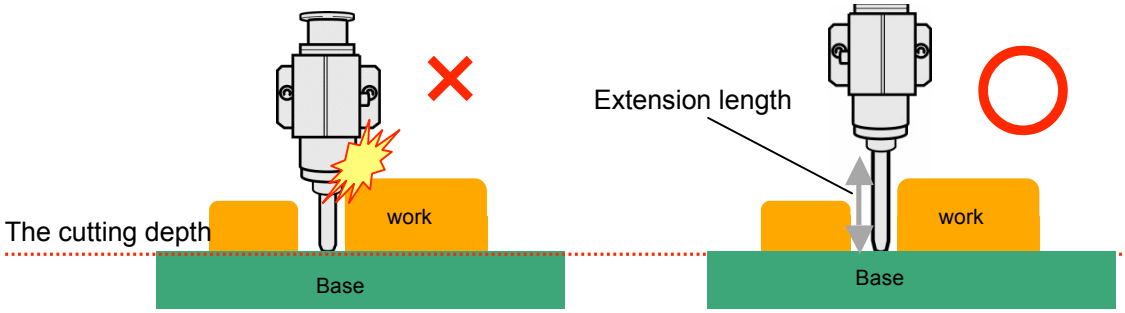


3 Tighten the tool using the two spanners (large and small) included in the accessory box.
Ensure the tool is held securely, but do not over-tighten. Excessive force may damage the collet or the spindle base.



Tool extension length

This is the length from the base of the collet to the tool tip.
The extension length should be enough to ensure the tool can cut the entire depth without the collet or spindle body making contact with the workpiece.



Setting the X- and Y- axis Origin Point

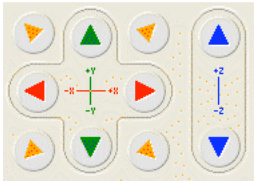
1 Draw diagonal lines from the corners of the base material. This will give you the centre of the material.

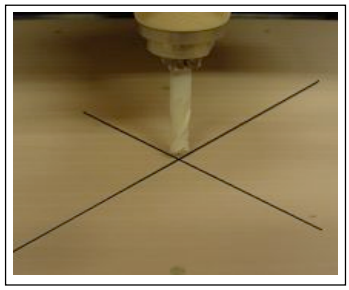
2 Start VPanel

Change coordinate select (option [①] in the diagram) to [User Coordinate System]

【User Coordinate】
This allows the user to set the origin in any position.
【Machine Coordinate】
These are the coordinates of the machine and the origin is set at the initialisation point (after machine registers limit switches. You cannot change this origin.

3 Use cursor keys to move the tool tip to the center of the base.





4 Set XY origin from VPanel.

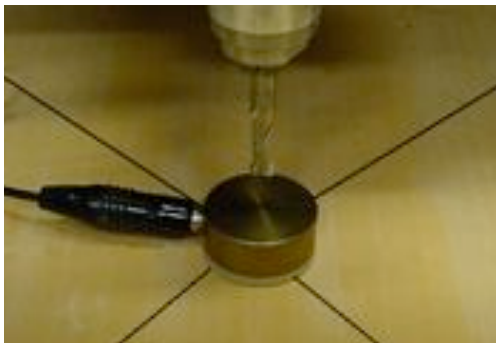
①From origin setting select [Set X origin here] then click [Apply] button

②Check that each XY origin coordinate now reads [0.00]

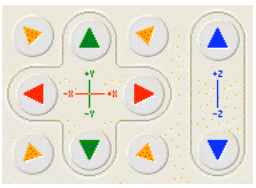
Setting the Z-axis Origin Point

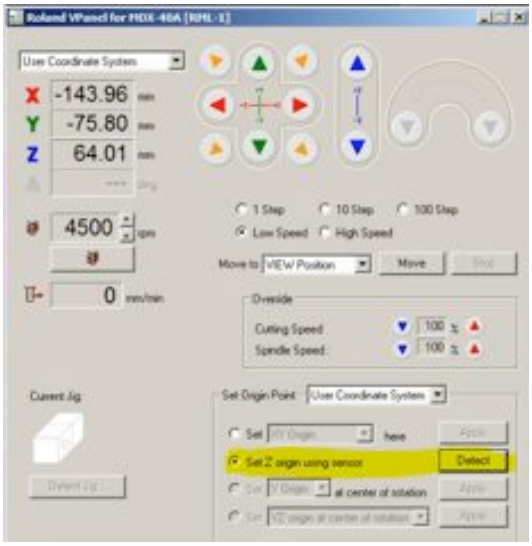
1 Place Z0 sensor on the base

Refer to User's manual Chapter 5 Appendix , 5-1 'Using the Z0 Sensor' for details of how to use the Z0 sensor.



2 Use cursor keys to move the tool to the position above the sensor.



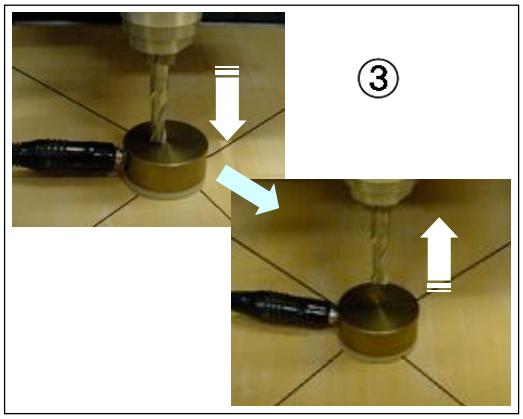


3 Set Z0 sensor from VPanel

①Check [Set Z origin using sensor]
②Click [Detect]

③The tool slowly descends until it makes contact with the sensor.
When the tool rises and stops, the setting operation is complete.

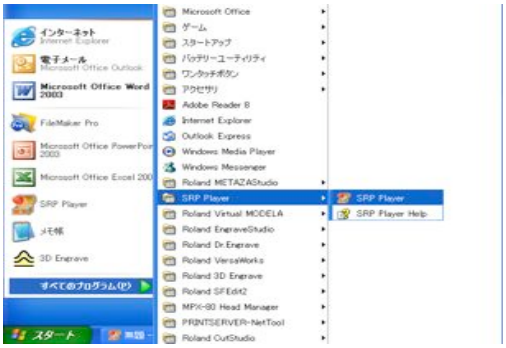
④Remove the Z0 sensor from the base and use the cursor keys to lower Z onto surface of base material to confirm Z coordinate reads [0.00].



Z0 indicates the position where the coordinate value is set "0" as the origin of Z coordinate.

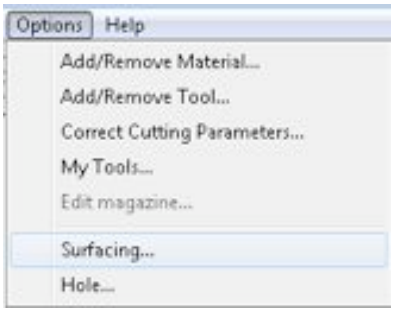
Surface levelling the base

1 From Windows [Start], choose [All programs] (or [Programs] then choose [SRP Player]

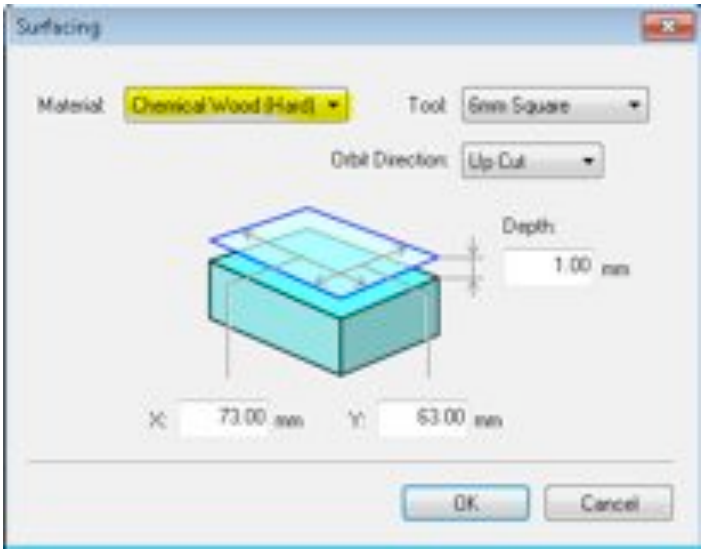


2 SRP Player starts

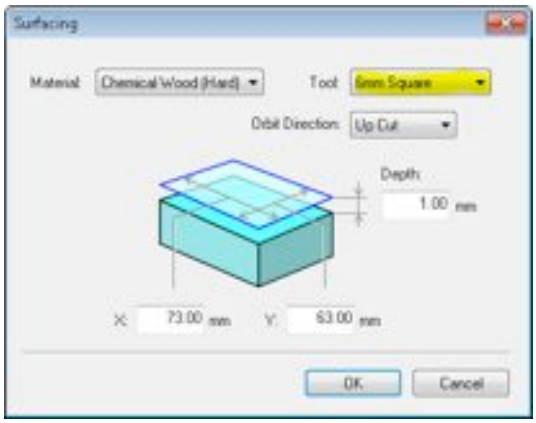
3 Select from menu [Option] [Surfacing] to show surface levelling display.



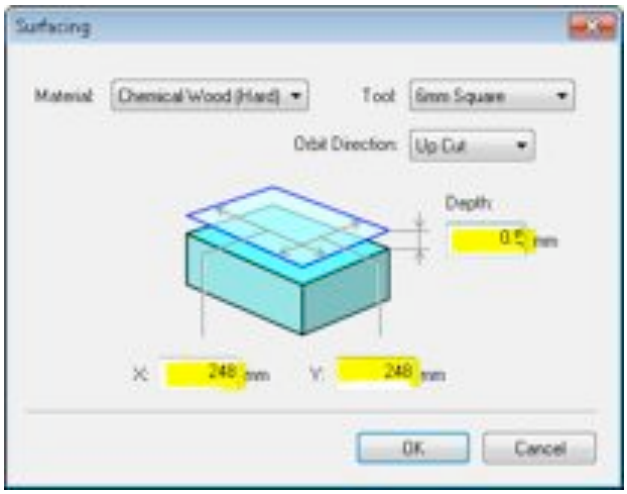
4 Set the material to [Chemical wood (hard)].



5 Set the tool to 6 mm Square.



6 For this guide, set the surface levelling area in both X and Y to [248] to correspond with the dimensions of the base material.



7 ①Set the depth of surfacing relative to the unevenness of your material. For this guide, input [0.5mm]

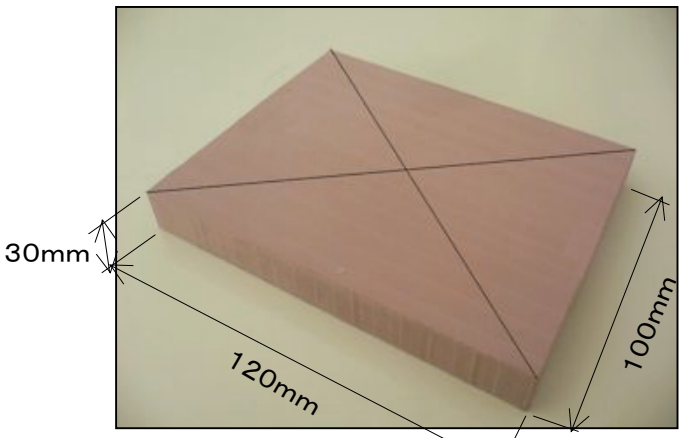
②Clicking [OK] button to start cutting

If you open the front cover of the MDX-40A while cutting, the spindle and axes will lose power. You cannot continue cutting after an 'emergency stop' error.

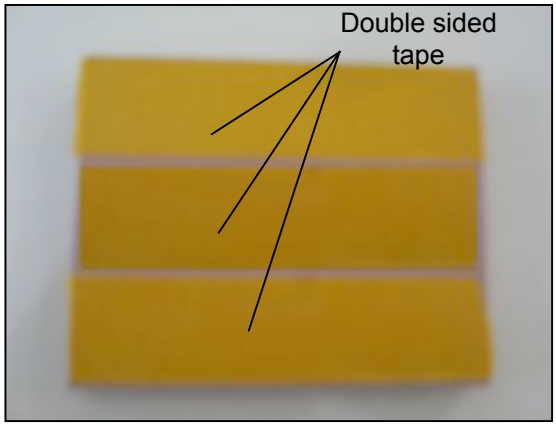
Completed surfacing

Preparation of the workpiece for model and surface levelling

1 Prepare the model workpiece using the size 120mm x 100mm x 30mm.
Draw the diagonal lines as with the base to locate the centre origin.
Apply double-sided tape to the entire area on the back of the workpiece.



Top of model workpiece



Underside of model workpiece

2 Remove the backing from the double sided tape and fix the model workpiece to the base.

※Ensure both surfaces are clean and free from dust and swarf.

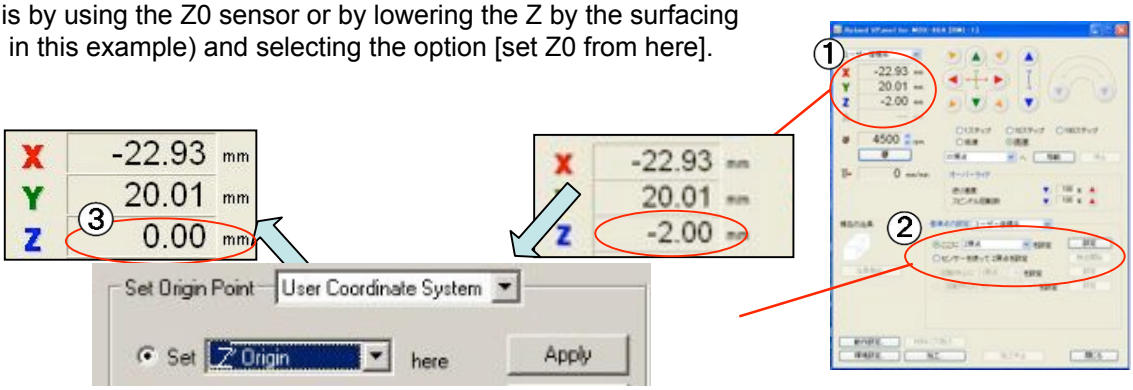
3 Perform surface levelling repeating the process from Page 19 in this guide.

Set the surfacing area to 120 x 120mm.

Set surfacing amount to 2 mm.

4 After surface levelling has completed, using Vpanel, set Z origin on the surface of the workpiece.

You can do this by using the Z0 sensor or by lowering the Z by the surfacing amount (2mm in this example) and selecting the option [set Z0 from here].



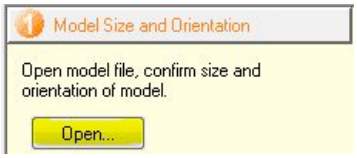
Step 4.

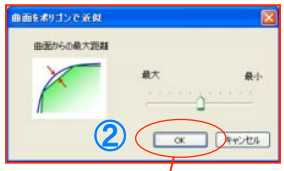
Creating the tool path

This step is about setting the method of each process that is common to each step of SRP Player.

Setting each process

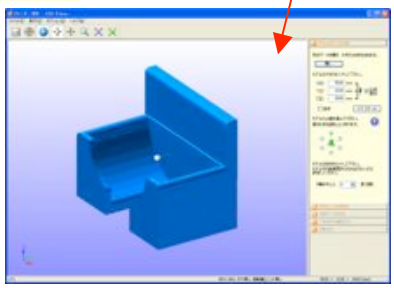
1 ①Import model data.





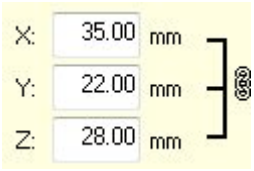
Click[File][Open] from the top menu bar and open the file [Z0SENSOR_HOLDER.igs] from where it is saved on your computer.

② The dialog box is shown. Click [OK] and the model will be shown in the display.

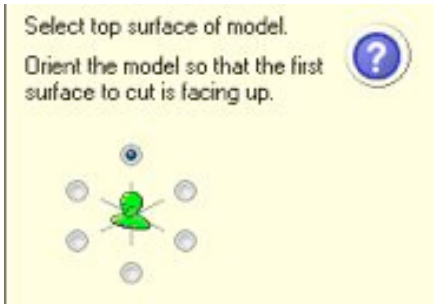


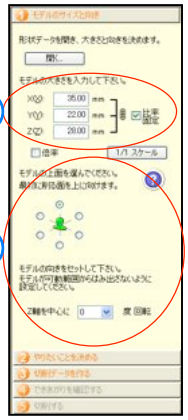
2 Check the model size and direction is correct.

①

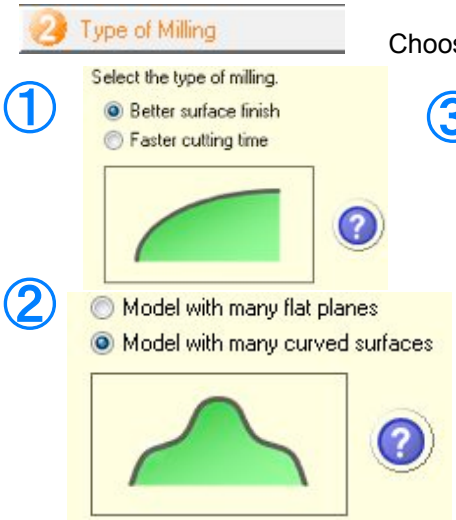


②

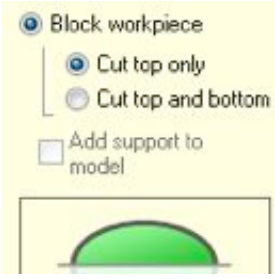


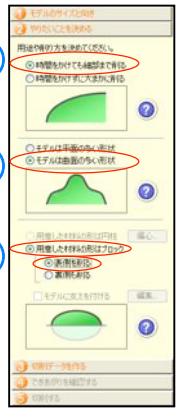


3 Choose the most appropriate for the 3 settings below.



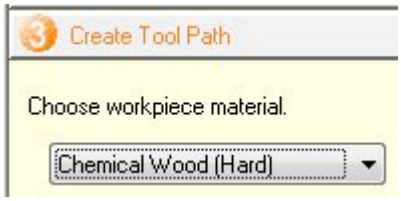
③





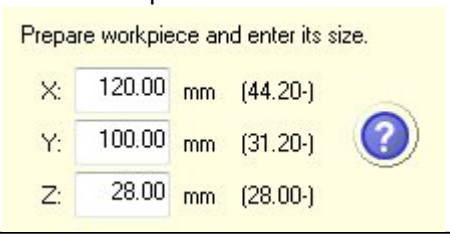
4 Choose the correct material from

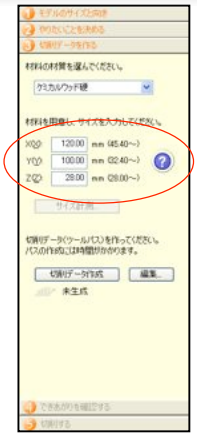
In this guide, choose chemical wood (hard).



5

Input the size of workpiece for model.

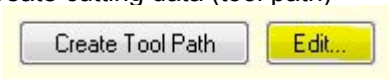




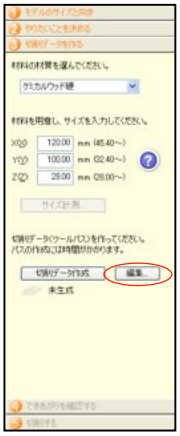
> The values in brackets ( ) represent the maximum model size in each axis. Your workpiece needs to exceed these measurements.

6

Create cutting data (tool path)

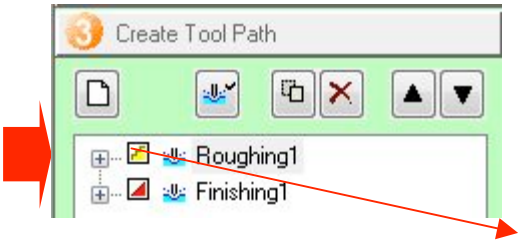


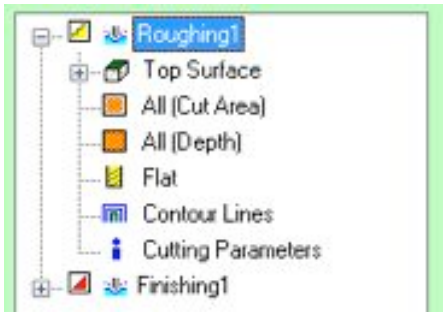
Click [Edit] button.

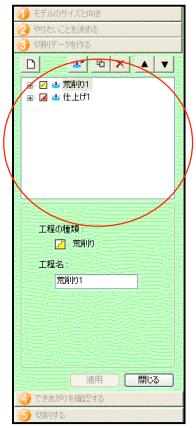


7

Set up the rough cutting values.
Click on the '+' position shown below. The pallet menu will expand.



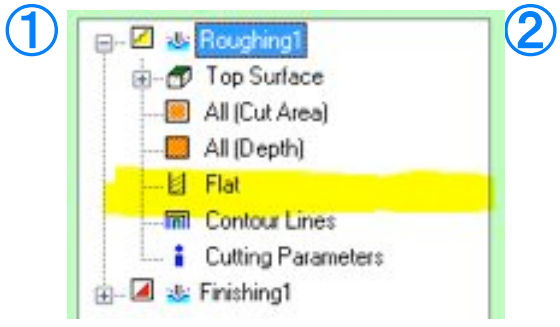




8

Select the tool

① Select tool pallet.
② Select [6mm square]
③ Click [Apply]



Tool to use for this process
6mm Square
Tool Type: Straight
Material: Cemented carbide
Flute Diameter [d]: 6.00 mm
Flute Length [l]: 25.00 mm
Corner Radius [r]: 0.00 mm
Blade Width [w]: 0.00 mm
Blade Angle [a]: 0.00 deg

9 Set the margin

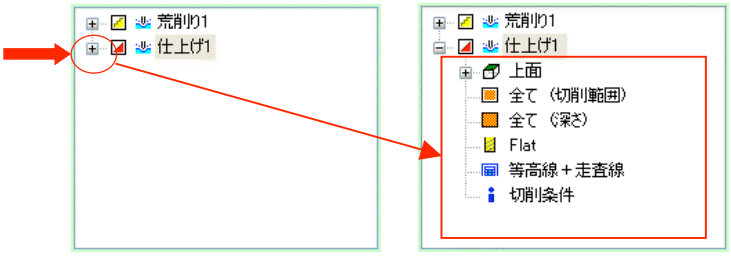
①Click the '-' position as below to expand the frame pallet.
② 自動入力 Click [Automatic], the automatic value is relative to the tool diameter.
③ Click [Apply]
④ Click [Close]

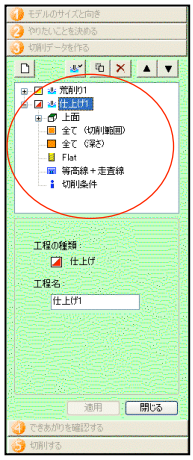
What is the margin?
The margin is an additional area around the model which is cut in order to allow the model circumference to be completed.

If no margin is set, cutting is limited to the inner model area. If too large a margin is set, cutting time will be excessive.

10 Set up finishing

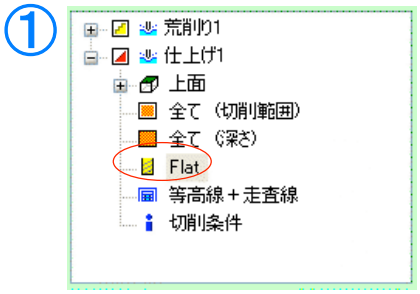
Click the '+' mark as below. The expanded pallet menu is shown.

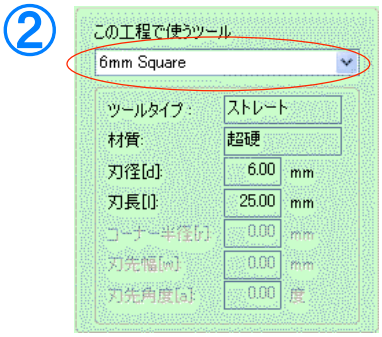


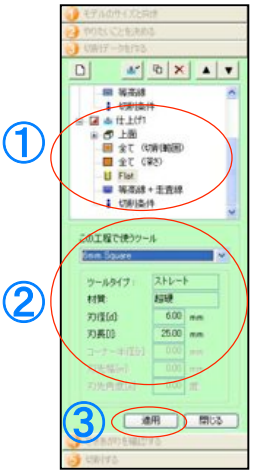


11 Select the tool

① Select tool pallet.
② Select [6mm square]
③ Click [Apply]

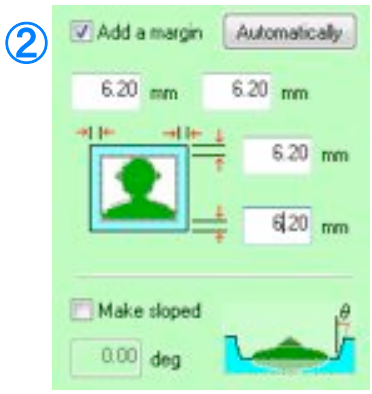






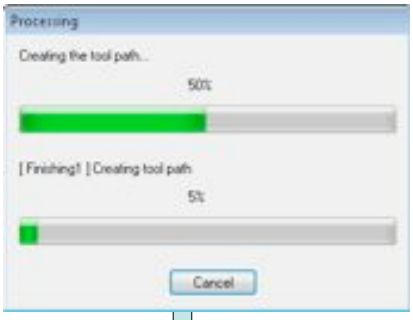
12 Set the margin

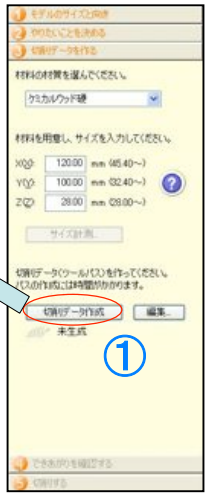
① Click the '-' position as below to expand the Modelling Form.
② Click [Automatic], the automatic value is relative to the tool diameter, plus a margin.
③ Click [Apply]
④ Click [Close]

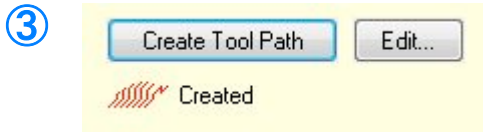


13 Generating cutting data

①Clicking [Create Tool Path | Edit...] generates the toolpaths sequentially.
②The toolpath generation progress is shown as a percentage.
③When tool path generation is complete, the display changes to [Created]







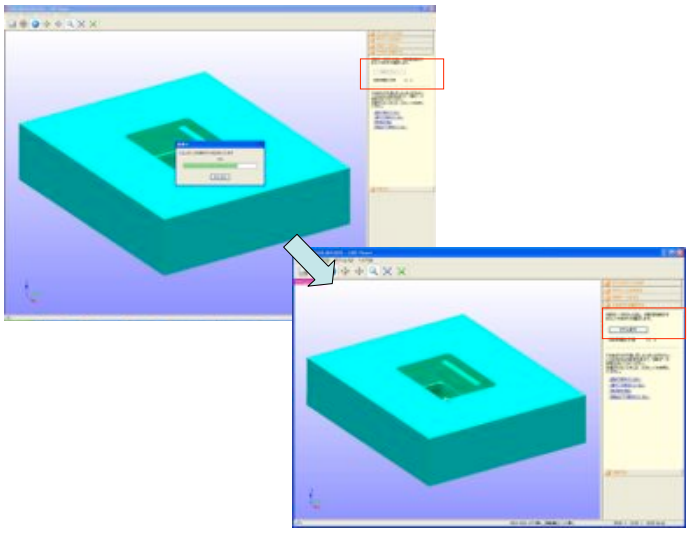
14 Check the cutting data

Click

Preview Results
After generating tool paths, you can preview cutting before operating milling machine.
Preview Cutting

① Click [Preview].
The cutting progress is simulated.

② Click [Show model].
The completed model is displayed.



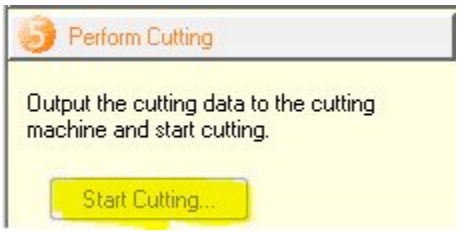
From menu, select [File] – [Save as] (or [Save])
and save the Whole project.

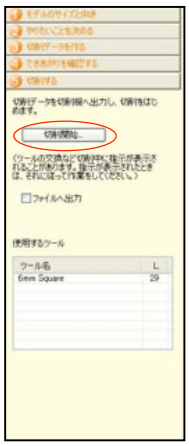
Step 5.
Cutting the model

This step is explains the cutting process.

Start cutting

1

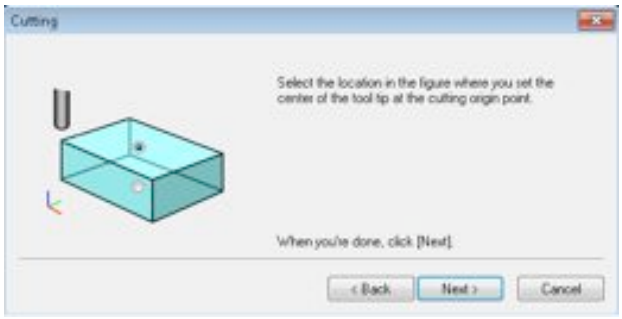




Click [Start cutting] from [Perform Cutting tab]

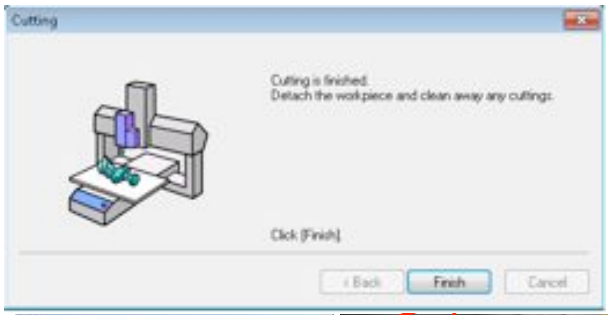
2

As we have already surfaced the model work piece, and we have already set the XYZ origin, so no changes are required.
Click [Next] to continue.


Cutting
Select the location in the figure where you set the center of the tool tip at the cutting origin point.
When you're done, click [Next].
< Back
Next >
Cancel

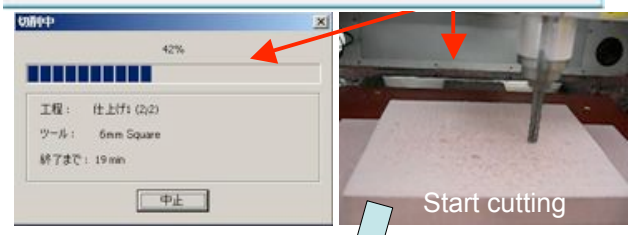
3

Click [Next] to start cutting



①While cutting, the cutting progress is displayed.
The MDX-40A now starts cutting.

② When all the data has been machined, the MDX-40A will stop cutting and 'Finished' will be displayed.
Open front cover and clean off the cutting waste.



If you open the front cover of the MDX-40A while cutting, the spindle and axes will lose power. You cannot continue cutting after an 'emergency stop' error.

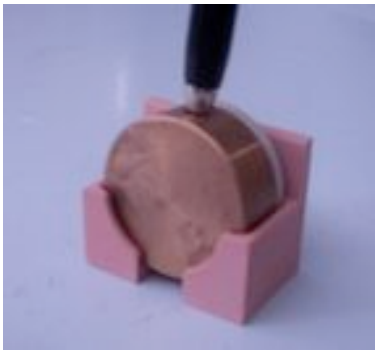
4

Remove the workpiece from the base using a scraper

※Take care when removing the model. The scraper may damage the modelling board if excessive force is used. Gently slide the scraper between the base and model to loosen the double sided tape.

Scraper

Once complete, you can stick the sensor holder with double sided tape to the side of the MDX-40A.



Complete